MONGOLBANK
CENTRAL BANK OF MONGOLIA

BANKING SECTOR CLIMATE SCENARIO ANALYSIS RESULTS 2024-25

August 2025

Bank of Mongolia

About this document

This document presents the results of the first climate scenario analysis (CSA) for the banking sector, undertaken by the Bank of Mongolia between October 2024 and July 2025. It is intended to provide policymakers, regulators, financial institutions, and other stakeholders with an overview of the methodological approach applied, the climate scenarios assessed, and the key findings that emerged from the exercise. The report summarizes both quantitative estimates of credit risk exposures and financed emissions, as well as qualitative insights into the current state of climate risk management practices in the banking sector.

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Contents

List of figures and tables

Abbreviations and acronyms

B2	Below 2^0 C Scenario	LGD	Loss Given Default
CO2	Carbon dioxide	MET	Ministry of Environment and Tourism
CP	Current Policies Scenario	MIK	Mongolian Mortgage Corporation
CSA	Climate Scenario Analysis	MNT	Mongolian Tögrög
DT	Delayed Transition Scenario	NAMEM	National Agency for Meteorology and Environmental Monitoring
EAD	Exposure at Default	NGFS	Network for Greening the Financial System
ECB	European Central Bank	NPL	Non-performing Loan
ECL	Expected Credit Loss	PD	Probability of Default
EL	Expected Loss	RCP	Representative Concentration Pathway
ESG	Environment, Social and Governance	RCSA	Risk and Control Self-Assessment
GHG	Greenhouse Gas	RE	Renewable Energy
ICAAP	Internal Capital Adequacy Assessment Process	REMIND	REgional Model of Investment and Development
IFRS	International Financial Reporting Standards	SME	Small and Medium Enterprise
ILAAP	Internal Liquidity Adequacy Assessment Process	TCFD	Task force for Climate Related Financial Disclosures
IPCC	Intergovernmental Panel on Climate Change	US	United States
IPPU	Industrial Processes and Product Use	USA	United States of America
ISIC	International Standard Industrial Classification	VAR	Value at Risk
		WI	Winter Intensity Index

Executive summary

This report presents the findings of Mongolia's first climate scenario analysis (CSA), conducted by the Bank of Mongolia between October 2024 and July 2025, to assess the banking sector's exposure to climate-related risks. The exercise comes at a time when Mongolia faces growing vulnerability to both transition risks from the global shift to a low-carbon economy and physical risks such as dzuds, droughts, and floods. As part of the central bank's mandate to safeguard financial stability and in line with the government's Monetary Policy Guidelines 2022 and 2024, the first CSA aimed to build institutional capacity, enhance understanding of climate risks, and identify data and methodological gaps that could inform future supervisory practices.

The analysis was based on three transition scenarios derived from the Network for Greening the Financial System (NGFS) pathways, namely Current Policies (continuation of existing policies), Below 2°C (an orderly transition aligned with limiting warming to below 2°C), and Delayed Transition scenario (a disorderly and more disruptive shift after a period of inaction). These are supplemented by physical risk scenarios reflecting acute hazards specific to Mongolia, including combined dzud and drought shocks as well as severe flooding. Seven commercial banks, including five systemically important banks, participated using a static balance sheet approach. They estimated sector-level credit risks, including probability of default (PD), loss given default (LGD), and expected credit loss (ECL), while also calculating financed emissions and responding to a qualitative survey on broader climate risk management practices.

The first estimates highlight that climate risks could significantly increase credit losses across the banking sector. Under the transition scenarios, expected credit losses increase by 11–14 per cent by 2030, with the sharpest increase under the Below 2°C (orderly transition) scenario, reflecting the impact of short-term policy shocks. By 2050, the Current Policies (no additional actions) pathway results in the highest losses, up 17.3 per cent relative to baseline projections, underscoring the long-term costs of inaction. Physical risks pose even greater threats: combined dzud and drought shocks raise expected credit losses by 11.7 per cent in 2030 and 22.7 per cent in 2050, while flood risk assessments show that approximately two-thirds of mortgages and collateralized loans are concentrated in very high-risk zones, exposing banks to substantial potential losses.

The financed emissions assessment revealed that bank lending contributes to around 23 per cent of Mongolia's total national emissions, with significant exposures in agriculture, manufacturing, and transport. These findings point to both risks and opportunities, as banks could play a decisive role in decarbonizing high-emission sectors while aligning their portfolios with climate objectives. Qualitative findings show that climate risk assessments

within banks remain at an early stage, largely qualitative, and inconsistent across institutions. While most banks have business continuity and basic risk management frameworks, they lack sector-specific models, comprehensive data systems, and robust integration of climate risks into market, liquidity, and legal risk assessments. Insurance coverage remains inconsistent across asset classes, and disclosure practices remain nascent and underdeveloped.

These results represent the first estimates, and the Bank of Mongolia is cognizant that modeling capabilities must be further developed and scenarios more closely tailored to Mongolia's national context. Despite these limitations, the CSA exercise has been successful in meeting its objectives, providing important lessons learned, and establishing the foundation for future system-wide climate risk assessments.

Overall, this first CSA marks a pioneering step in strengthening Mongolia's banking sector resilience to climate change. It has built initial capacities among banks, provided critical insights into transition and physical risk impacts, and identified clear priorities for methodological refinement and supervisory guidance. The Bank of Mongolia will continue to support banks in developing sector-specific risk models, improving data collection, and embedding climate risks into policy and supervision frameworks. Going forward, sustained collaboration, capacity building, and iterative scenario analysis will be essential to ensure that the Mongolian financial system is equipped to manage the growing risks of climate change while supporting an orderly transition to a low-carbon economy.

Introduction

Increasing greenhouse gas emissions from human activities are causing climate change, which in turn affects the economies and financial systems of countries. The specific ways these effects will unfold are uncertain due to the complex and interconnected nature of the factors involved. However, what is known is that climate change is driving structural changes which pose risks to overall financial stability. Mongolia is especially vulnerable to climate change due to its geographic conditions and climate extremes.

Climate change-related risks to financial stability have several distinct characteristics. Climate change will affect all agents in the economy, across all sectors and geographies. The risks are non-linear, correlated, and may be amplified by tipping points, making their impact systemic and more widespread than that of other structural changes. Feedback loops between the macroeconomy and the financial system could further exacerbate these impacts and risks. Moreover, the exact outcomes, time horizons, and pathways of these risks are marked by a high level of uncertainty. The magnitude and nature of the future impacts will depend on the actions taken today.

The exact pathway of how the dire effects of climate change will manifest remains uncertain due to the complex, systemic, and interconnected nature of the causal factors. Historical trends do not translate directly to the future and risks involve complex dynamics that interact with each other through different aspects in the short, medium, and long term.

To address these risks, many regulators have turned to climate risk scenario analysis as an option to assess future long-term risks as it offers a flexible 'what-if' methodological framework that is better suited to exploring the risks that could crystallize in different possible futures.[1] By 2022, 53 institutions, from 36 jurisdictions, had completed, or were conducting, or are planning to conduct a climate scenario analysis exercise.[2] Several other regulators like the National Bank of Georgia, Hong Kong Monetary Authority and the Bank of Armenia have since completed one round of climate risk assessments.

The Bank of Mongolia as part of its primary objectives contributes to the balanced development of the national economy by the way of ensuring the stability of financial markets and the banking system.[3] Greening the financial sector has been established as a critical goal of the government's Monetary Policy Guidelines 2022 and 2024. Within its mandate to assess and manage climate-related risks to the financial sector the Bank of Mongolia initiated its first pilot climate scenario analysis between October 2024 and July

[1] Guide to climate scenario analysis for central banks and supervisors June 2020.

[2] Financial Stability Board (FSB) 2023.

[3] Law Of Mongolia On Central Bank (Bank Of Mongolia), September 3, 1996. Article 4 Primary Objective of the Bank of Mongolia.

2025. A workshop was held in October 2024 to officially launch the Climate Scenario Analysis exercise.

Overview of climate scenario analysis

Objectives

The bottom-up climate scenario analysis aimed to raise awareness about the climate-related risks for the banking sector, strengthen the capacities of the Bank of Mongolia as a regulator and of the participating banks, and identify gaps in data and methodologies to estimate the climate-related risks.

The main objectives of this pilot Climate Scenario Analysis are as follows:

- Build capacities to understand, assess, and analyze climate-related financial risks within the banking system.
- Increase the understanding of the banking sectors' potential exposures to physical risks relevant to Mongolia's geography and to transition risks arising from domestic and international policy measures to move towards a low-carbon economy.
- Understand the data gaps (both climate and financial) and methodological challenges (e.g. estimating GHG emissions, quantifying potential losses, and assessing counterparty exposures) that affect the measurement of climate-related financial risks.

The results of the pilot exercise discussed in this report provide a strong foundation for the development and improvement of subsequent climate risk assessments and the overall strategy of greening Mongolia's financial system. Given the exploratory nature of the exercise and its objectives, the results of this exercise do not translate into changes in regulatory capital requirements for participating banks at this stage.

Participating institutions

Mongolia's banking sector is the backbone of the country's financial industry, with 12 banks driving 80 per cent of the finance industry, providing 45 per cent of domestic credit to private sector and with total assets of US$20.7 billion as of 2024.[4] Five systemically important banks collectively dominate around 90 per cent of total banking sector assets. Thus, to participate in this exercise the systemically important banks were selected. After the inception

[4] Based on data from National Statistics Office of Mongolia and IMF statistics.

workshop to launch the climate scenario analysis, two additional banks requested to join voluntarily.

Financial risks

Only credit risks were estimated under the scope of this exercise.

The goal of credit risk management is to maximize a bank's risk-adjusted rate of return by maintaining credit risk exposure within acceptable parameters.[5] As climate impacts or the transition to a low-carbon economy intensifies, borrowers in vulnerable sectors or regions may increasingly struggle to meet their financial obligations. This can lead to higher loan defaults and credit losses, thereby raising credit exposure for banks and potentially undermining their stability and resilience.

At the same time, Mongolia is also vulnerable to increasing physical risks particularly dzuds, droughts and floods. The impacts of floods will increase risks to the financial sector through disruption of businesses, loss of livelihoods, and majorly due to their impact on collateral and their repricing due to increased severity and frequency. While the impacts of slow-onset disasters like dzuds and droughts on agriculture, livestock and the herder populations cannot be understated. These consequences are transmitted to the financial system through multiple channels, from household incomes dependent on agriculture, to businesses reliant on agricultural inputs, and ultimately to Mongolia's export performance.

Thus, the exercise required banks to estimate credit risks under transition scenarios as well as under severe floods and a drought, plus dzud scenarios. However, banks' understanding and current level of preparation to mitigate against market, liquidity, legal and operational risks were assessed qualitatively.

Balance sheet method

The CSA applied a static balance sheet methodology, where the size and composition of a bank's balance sheet remained unchanged over the scenario horizon. The banks were instructed to replace the loans that mature within the analysis period with similar loans in the same sector with the same maturity. This approach allows the analysis to isolate the effects of climate change scenarios on banks' existing business models and portfolios, without incorporating potential future changes in strategy or balance sheet structure

[5] Principles for the Management of Credit Risk Basel Committee on Banking Supervision Basel September 2000 Basel Committee Publications - Principles for the Management of Credit Risk - Oct 2000 (bis.org)

Methodological approach

The climate scenario analysis followed a combination of top-down and bottom-up methodologies. The Bank of Mongolia defined the common set of scenarios and provided standardized scenario data inputs for the estimation of risks, while the banks using these inputs estimated credit risk parameters for their own portfolios.

The banks also shared methodological notes on the process of estimation of credit risks to ensure the quality of the process and data. This hybrid approach supported the development of capacities within banks supporting the exploratory objectives of the exercise. This will also allow the Bank of Mongolia to assess the various methodologies present and evaluate best practices.

Scenario narrative

Transition scenarios

NGFS scenarios were used as a starting point for this CSA as they provide a common reference point for central banks and users, have an annual release cycle, integrate both transition and physical risk, and have high sectoral granularity. Data from the REMIND-MAgPIE downscaling model for Mongolia and Nigem model for Asia was used as the starting point. Three NGFS scenarios were selected as a starting point for this exercise and were modified to incorporate Mongolia-specific details to produce the following scenarios:

- **Current Policies**: This scenario assumes that Mongolia continues with its existing climate policies without any significant new interventions or changes.
- **Below 2^0 C**: This scenario envisions Mongolia taking strong, immediate actions to limit global warming to below 2°C, aligning with the Paris Agreement targets.
- **Delayed Transition**: This scenario considers a late but abrupt shift towards stringent climate policies and measures, causing significant economic and financial adjustments in a short time frame.

Table 1 below summarizes the narratives for each scenario, to which a detailed explanation follows.

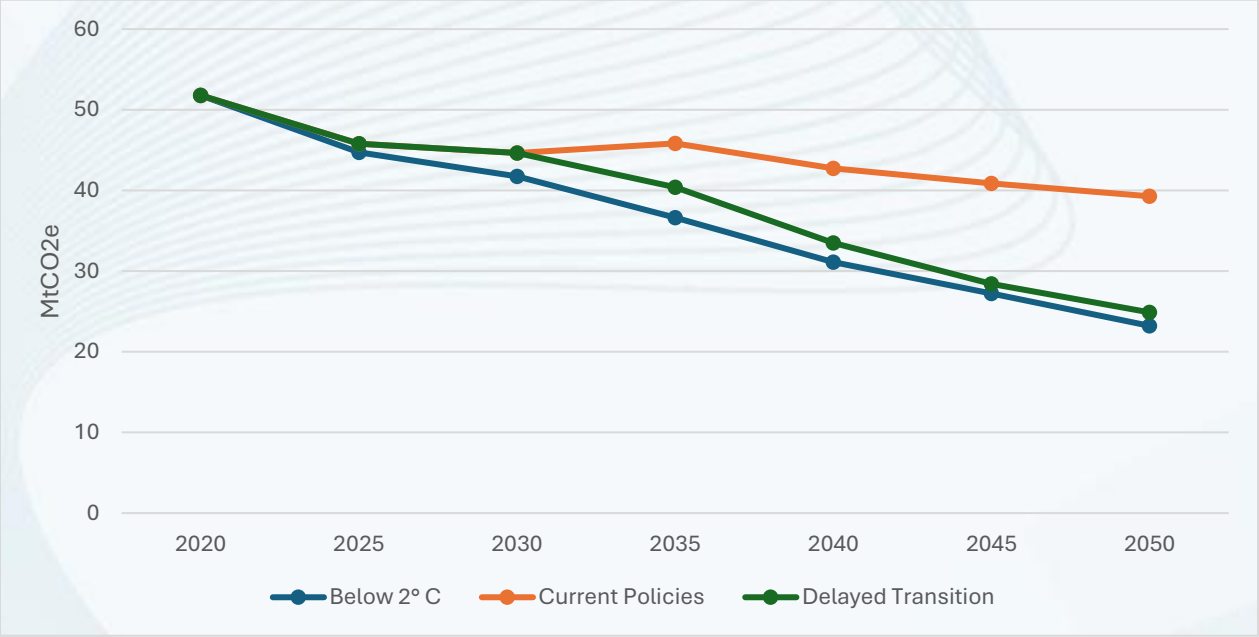
Table 1 Scenario narrative for climate scenario analysis

Scenario	Current Policies	Below 2^0 C	Delayed Transition
Global Temperature Target	3^0+	67 per cent chance of 1.6^0	1.7^0
Physical Risks	High	Medium	Medium
Transition Risks	Medium	High	High
Emission Reduction 2030	14 per cent	19 per cent	14 per cent
Emission Reduction 2050	24 per cent	55 per cent	52 per cent
Carbon Price Implementation	No Change	Immediate	After 2030
Carbon 2030 (US$/tCO2e)	5.63	35.2	5.63
Carbon 2050 (US$/tCO2e)	6.16	131.1	161.9
Final Energy Prices	Flat Final Energy prices	Immediate Price Liberalization	Price Liberalization after 2030
Energy Mix	• Coal phases down but remains a part of energy mix with small share of 8 per cent after 2050 • Liquids[6] phase down, small share of gases • RE capacity is slowly built till end of century, • Heating component increases to 50 per cent by 2050.	• Immediate and gradual Coal Phase out by 2030 • Higher share of liquids as transition fuel • Renewable energy component is scaled to 30 per cent share by 2050 • Heating component increases from 26 per cent in 2020 to 50 per cent in 2050	• Coal phase down till 2030, then drastic phase out by 2045 • Liquid used as bridge fuel • Renewable Energy capacity develops slowly • Heating share increases to 50 per cent in 2050.
Technology Change	Slow Change	Moderate Change	Slow Change till 2030 then Fast Change
CO2 Removal	Low Use	Medium Use	Medium Use
Regional Policy Variation	Low Variation all countries are not increasing ambition	Low Variation, all countries implement immediate coordinated policy action	High Variation due to sudden needs of transition to meet temperature targets

[6] Liquids include fossil fuel oils like diesel and gasoline.

The **Current Policies** scenario represents a pessimistic case where the global temperatures rise to more than 3^{0}C. Under this scenario, no additional policy is implemented other than those already in place. This leads to high physical risks and medium transition risks. There is no change in the carbon price[7] and emissions reduction is the least among all three scenarios. The energy prices have been modified to reflect starting point values for Mongolia, flat energy pricing is applied (as under current national policies) with a 15 per cent increase every 5 years to reflect increasing costs (without the impact of climate change). Parameters like inflation, interest rates, and exchange rates reflect these additional assumptions to incorporate the Mongolian context. The scenario still simulates a phase-down of coal by 2050, however, coal remains a part of the energy mix beyond 2050. Renewable energy capacity is assumed to develop gradually till the end of the century. Due to this policy environment, technological change is slow and there is low use of carbon dioxide removal technologies. All countries are assumed not to implement additional needed policies and hence the variation in policy across countries is low.

Figure 1 Emissions pathways under scenarios



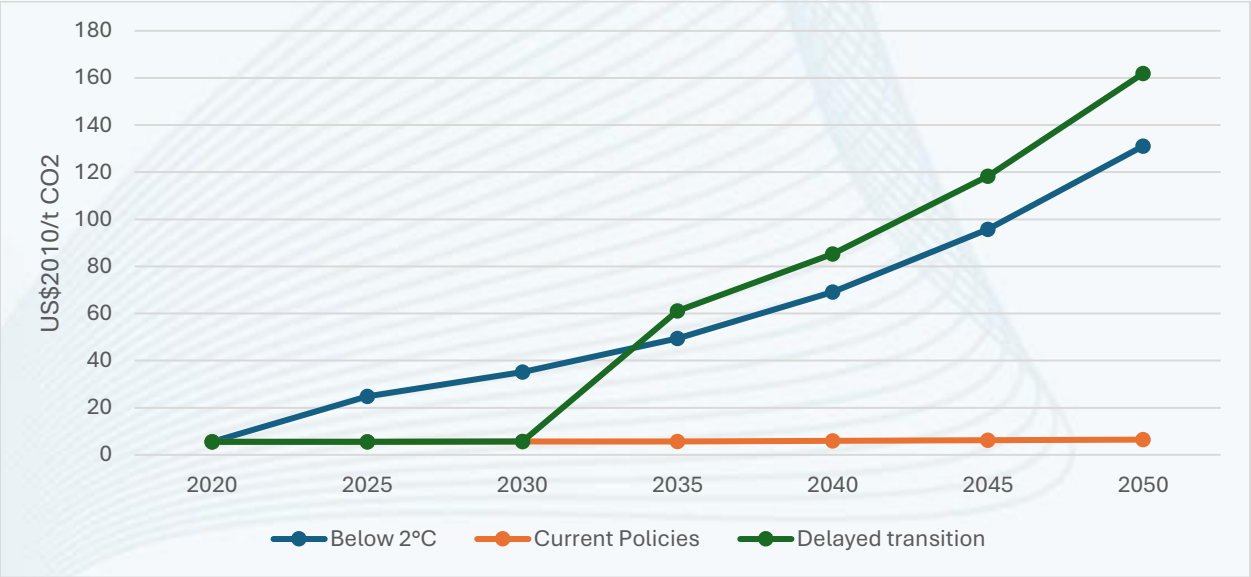
Source: ESCAP and Bank of Mongolia based on data from NGFS.

The **Below 2^0 C** Scenario is an optimistic case where there is a 67 per cent chance to restrict global to 1.6^0 C. Under this scenario there is immediate policy action required to reduce emissions; hence this scenario entails low physical risks but medium transition risks. Carbon Price increases immediately to reflect policy action to reduce emissions and

[7] The NGFS REMIND-MAgPIE Model downscaled for Mongolia assumes a constant carbon price of 5.54 US$ in Mongolia, this has not been changed despite the non-existence of a carbon price in the country for simplicity. Trends have been applied to starting point values from national sources (for example: prices for energy and fuel) to make the data more coherent with the national context.

gradually increases to achieve emissions reduction by 55 per cent (as compared to 2020) in 2050. It is additionally assumed that energy prices in Mongolia are liberalized and there is a price increase due to the combined effects of carbon prices and liberalization. The energy prices have been modified to reflect starting point values for Mongolia. However, after an initial shock from liberalization, the energy prices converge to the trend modeled by NGFS. These policies together lead to immediate and gradual phase-out of coal and faster scaling of renewable energy (+30 per cent by 2050) owing to moderate level technical change and carbon dioxide removal. The variation in policies across countries is low as all countries are assumed to take similar immediate action to reduce emissions.

Figure 2 Carbon price evolution under scenarios



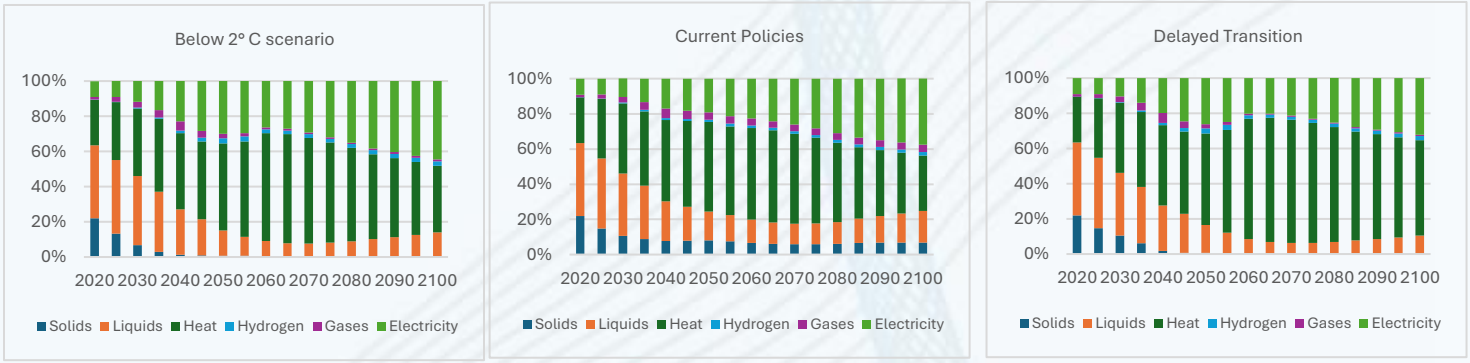
Source: ESCAP and Bank of Mongolia based on data from NGFS.

The **Delayed Transition** scenario presents a path between the above two scenarios. Where the policies needed to reduce emissions and limit global warming to below 2^0C (1.7^0 C as per the model estimates) are not implemented until 2030. This means that the scenario follows the current policy path until 2030. However, owing to delayed action, more stringent policies will be deployed at a faster rate from 2030, leading to medium physical risks and high transition risks[8]. Carbon prices do not increase till 2030, and energy pricing is flat with a 15 per cent increase every 5 years owing to higher costs. The carbon price in this scenario is the highest by 2050. The energy prices are liberalized from 2030 and hence increase steeply from 2030 and gradually converge to NGFS model trends. These policies lead to a slow phase-down of coal till 2030 and then a phase-out by 2050. Renewable energy deployment is also scaled up after 2030. Technological change is slow till 2030 and then

[8] Transition risks in Delayed Transition scenario are highest amongst the three chosen scenarios.

rapid afterwards. There is high variation in policies across countries due to the urgency for a transition from 2030 to meet the temperature targets.

Figure 3 Final energy share by source

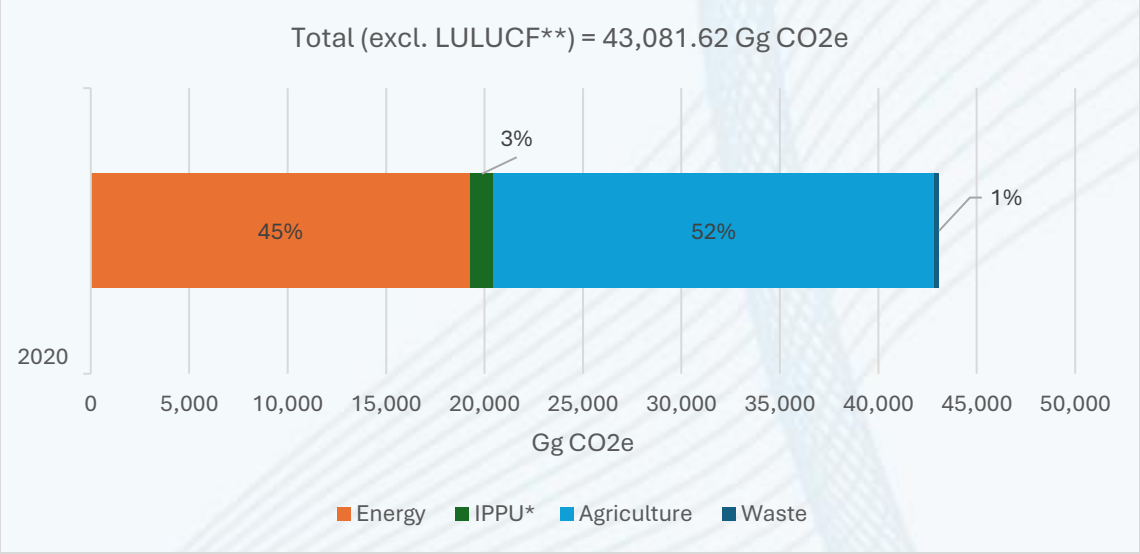


Source: ESCAP and Bank of Mongolia based on data from NGFS.

The national emissions inventory for Mongolia from the Ministry of Environment and Climate Change (MECC) categorizes sectoral emissions under Energy, Industrial Processes and Product Use (IPPU), Agriculture, and Waste with data through 2020 (See Figure 4).[9] The inventory also provides Tier 1 key category analysis[10] which has been used to disaggregate emissions by sector at ISIC level 1[11] following the methodology developed by Sparkassenstiftung and MSFA. The CSA exercise used ISIC classification (Table 2) and emissions data from the national inventory (Figure 4).

[9] Mongolia's National Inventory Report-2023 Annex to Second Biennial Update Report To UNFCCC.
[10] Mongolia's National Inventory Report-2023, Page 188.
[11] The International Standard Industrial Classification of All Economic Activities (ISIC) consists of a coherent and consistent. classification structure of economic activities based on a set of internationally agreed concepts, definitions, principles and classification rules. ISIC Revision 5 Introduction (un.org).

Figure 4 Aggregated GHG emissions and removals by sectors



Source: Mongolia's National Inventory Report-2023 Annex to Second Biennial Update Report To UNFCCC

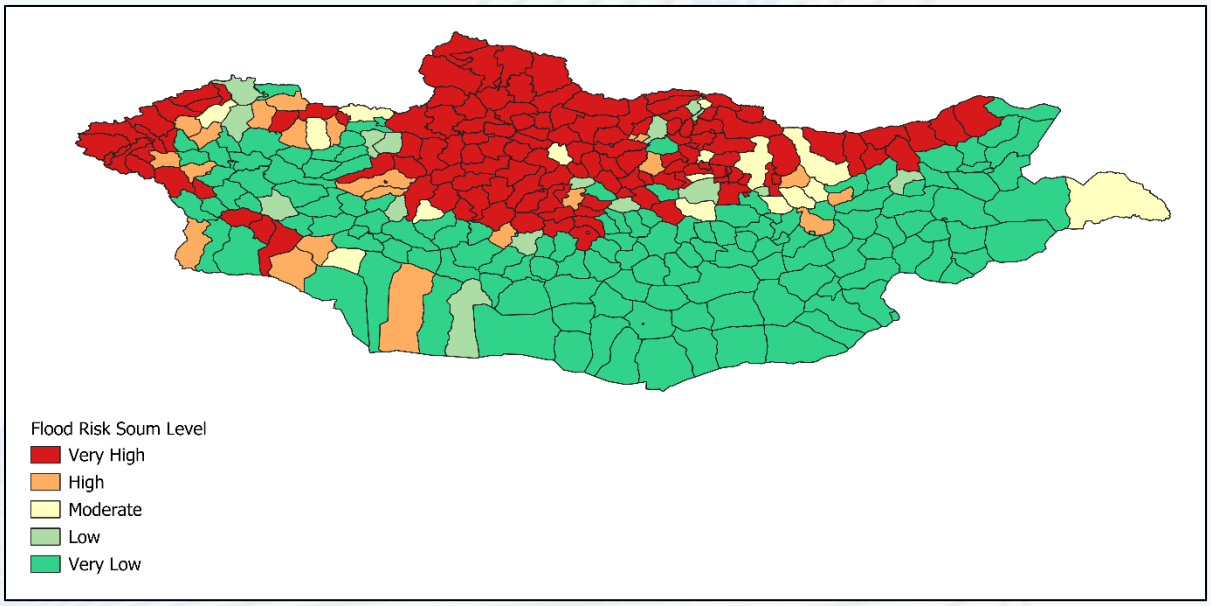
Table 2 ISIC classification and associated sectors

Code (Level 1)	Sector (Level 1)
ISIC-A	Agriculture, forestry and fishing
ISIC-B	Mining and quarrying
ISIC-C	Manufacturing
ISIC-D	Electricity, gas, steam and air conditioning supply
ISIC-E	Water supply; sewerage, waste management and remediation activities
ISIC-F	Construction
ISIC-G	Wholesale and retail trade; repair of motor vehicles and motorcycles
ISIC-H	Transportation and storage
ISIC-I	Accommodation and food service activities
ISIC-J	Information and communication
ISIC-K	Financial and insurance activities
ISIC-L	Real estate activities
ISIC-M	Professional, scientific and technical activities
ISIC-N	Administrative and support service activities
ISIC-O	Public administration and defense; compulsory social security
ISIC-P	Education
ISIC-Q	Human health and social work activities
ISIC-R	Arts, entertainment and recreation
ISIC-S	Other service activities
Others	Miscellaneous
Herder Loan	Herder Loan

Flood scenario

Based on historical data from the National Agency of Metrology and Environmental Monitoring (NAMEM) and forward-looking data from the Climate Analytics Climate Impact Explorer, a soum (district)- level flood risk map was developed that classifies soums into very high, high, moderate, and low-risk zones.

Figure 5 Flood risk map at soum level[12]



Source: ESCAP and Bank of Mongolia based on data from NEMA.

A price shock to residential and commercial properties, as outlined in Table 3, was defined for each type of risk zone to be applied by participating banks. House price effects are less explored in the literature, particularly in the context of Mongolia. Due to unavailability of data, the starting point values were taken from the ECB[13] climate stress test and adapted using studies available in the literature for other countries like Malaysia, Thailand, China and USA.[14] These were also found consistent with the study conducted by the Mongolian Mortgage Corporation (MIK) for flood risk in Ulaanbaatar. However, these values remain informed estimates rather than actual price shock scenarios for the analysis, with the objective to understand the mortgage exposure to flood risk and pilot the methodology of estimating credit risks. For the CSA, the impact of flood risks were evaluated on the current portfolio of mortgages and loans collateralized by real estate as of December 2023.

[12] The flood risk map is a compound risk indicator reflecting risks to populations, households, house area, dwellings, Education and Health Facilities, Gas Stations, Warehouses and Mining sites based on the study ADB, NEMA | TA-9880 MON: Strengthening Capacity on Disaster Risk Assessment, Reduction, and Transfer Instruments in Mongolia National Disaster Risk Assessment of Mongolia |September 2023.

[13] Table A, Pg. 18, 2022 climate risk stress test – Methodology, scenarios and quality assurance, ECB July 2022.

[14] Ismail et. Al 2014, Wei F, Zhao L. 2022, Sawada et al. 2018, Holtermans et al. 2024, Miller et al. 2021,

Table 3 Real estate price shock for flood scenario

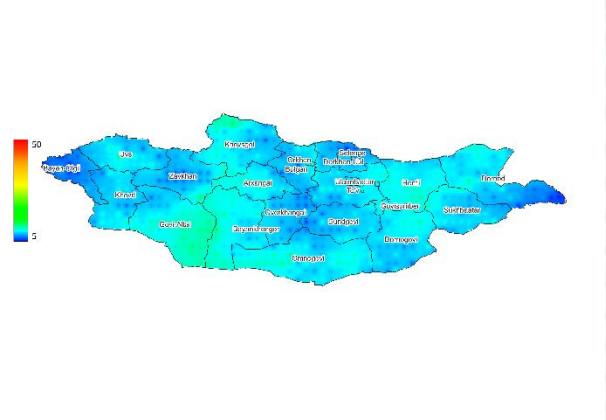
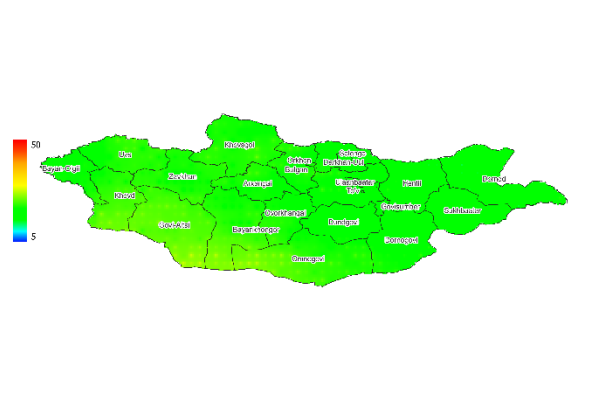
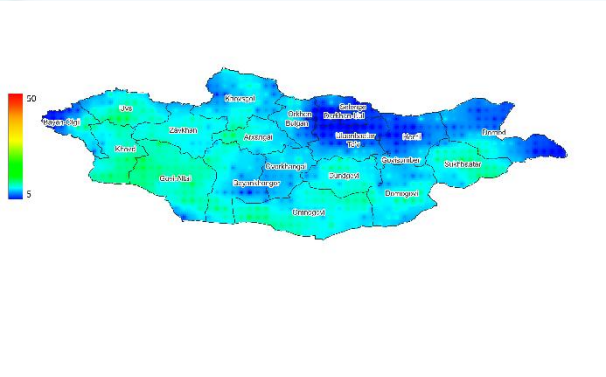
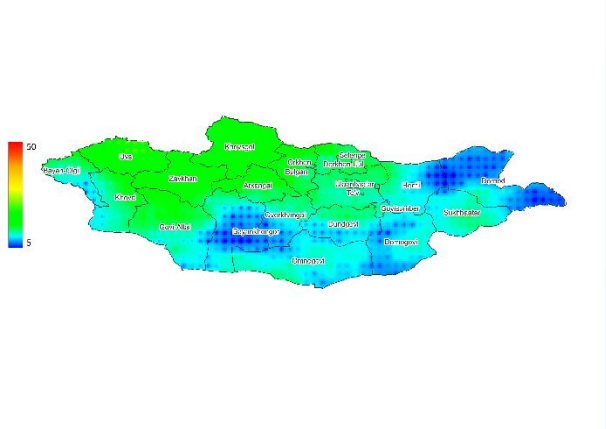
Flood Risk of the area	Commercial Real Estate Price Shock	Residential Real Estate Price Shock
Low	0 per cent	0 per cent
Moderate	0 per cent	0 per cent
High	-3 per cent	-5 per cent
Very High	-9 per cent	-12 per cent

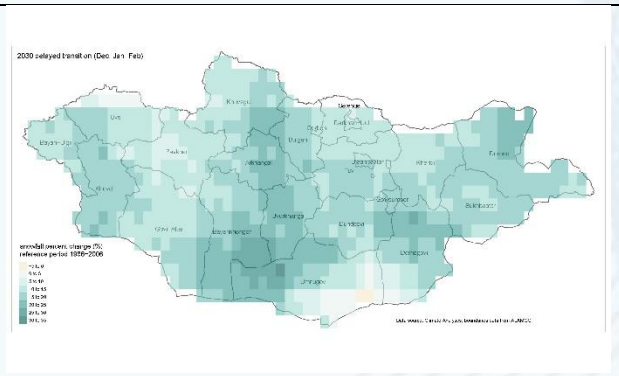
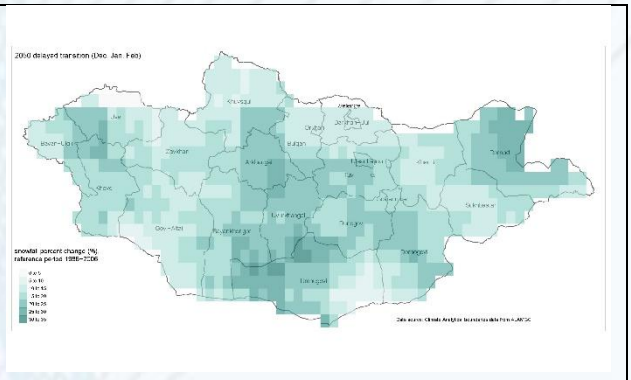
Dzud + drought scenario

The severe scenario represented a combined effect of droughts and dzud. It was assumed that a drought occurs in the summer and is followed by a dzud in the winter. This scenario was designed to subject the loan portfolios to severe stress. For instance, in the Gobi region, the average annual livestock mortality for years with a combination of drought and dzuds (18 per cent) was 4.8 percentage points higher than in the years with dzuds alone, and 7 per cent percentage points higher than in years with drought alone. To quantify the credit risks coming from dzuds and drought in 2030 and 2050, the adverse case scenarios were defined for these years, assuming a combination of drought and dzud occurs. This assumption is reasonable given that the frequency of both droughts and dzud increases is projected to increase under the adverse and even moderate climate scenarios.

Using the forward-looking data from NAMEM studies that use the RCP8.5 scenarios and assumptions based on literature and historical data the scenario descriptor as outlined in Table 4 for an adverse case of Dzud + Drought. (Baseline 1986-2005 until specified otherwise). The scenario specific macroeconomic input parameters for the “Dzud and Drought Scenario” were provided to the banks for credit risk estimations.

Table 4 Dzud + Drought scenario descriptor

Variable	2030	2050
Frequency Increase of Drought	5-15 per cent	15-35 per cent
Geographical Distribution of Frequency increase of Drought		
Winter-Harsh Winter Intensity Index (WI)	0.27	0.98
Dzud Intensity Index	0.84	1.81
Frequency Increase for Dzud	5-15 per cent	5-35 per cent
Geographical Distribution of Frequency increase of Dzud		
Increase in Winter Period Snowfall (Dec-Feb)	5-35 per cent	10-45 per cent

Geographical distribution of Increase in Winter Period Snowfall (Dec-Feb)		
Livestock Mortality increase from current average	50 per cent	115 per cent
Projected Livestock Mortality	11.5 million heads	15.5 million heads

Transition risks as financed emissions

The GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard (referred to as the Scope 3 Standard)[15] defines 15 distinct reporting categories in Scope 3. For a financial institution, scope 3 category 15 emissions, i.e. financed emissions are often the most significant part of its GHG emissions inventory, and special consideration must be made regarding how these are measured.

Financed emissions are a necessary input for climate scenario analysis. As such, financed emissions are a key metric for financial institutions that want to understand and manage climate-related transition risks and opportunities. As countries strive to reduce emissions and efforts increase to develop policies that support decarbonization, the price of carbon-intensive activities through carbon pricing will increase. These policies could have material impacts on the viability of certain loans and investments in carbon-intensive industries. Measuring financed emissions can help financial institutions identify carbon-intensive concentrations in their portfolios and enable them to take the necessary actions to minimize their exposure to riskier assets and encourage them to develop climate-friendly products such as low carbon funds, green bonds, sustainability-linked bonds, green mortgages, and more.[16] Understanding a bank's financed emissions can also support its disclosure and

[15] Corporate Value Chain (Scope 3) Standard | GHG Protocol.
[16] The Global GHG Accounting & Reporting Standard for the Financial Industry, PCAF, Nov 2020.

reporting frameworks as recommended by the ISSB (building on the former TCFD recommendations).

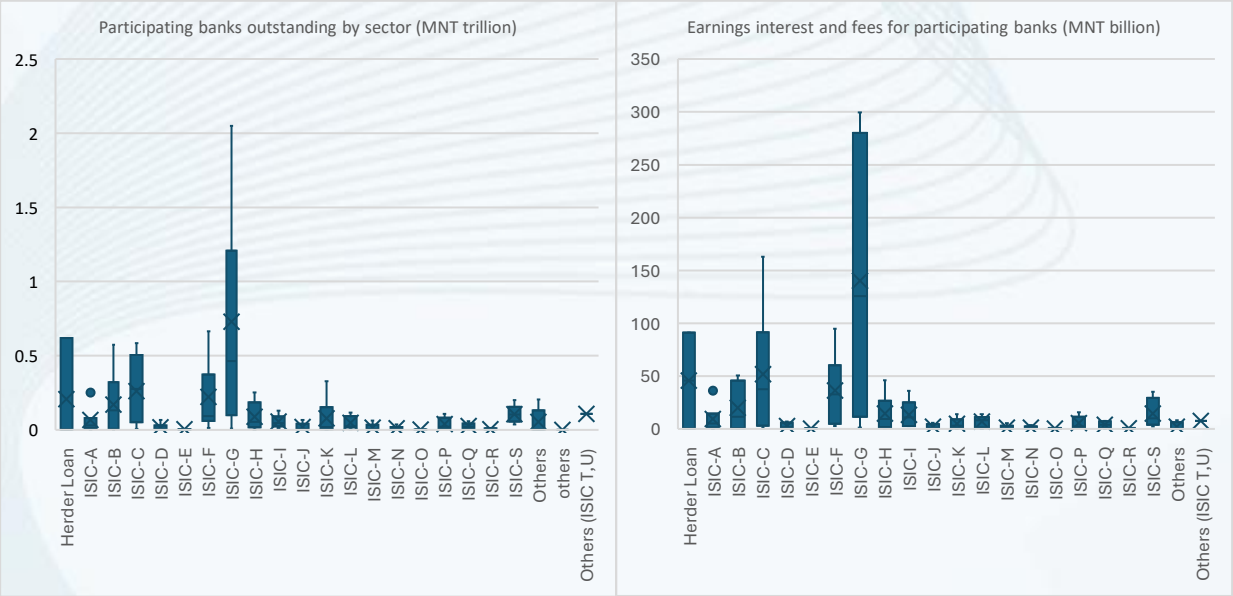
Banks were instructed to calculate financed emissions on their corporate and business loan portfolios.

Climate scenario analysis results

Credit risks in transition scenarios

Under the climate scenario analysis exercise, banks classified their business and corporate loan portfolios by sector using ISIC level 1 classification. An additional category of herder loans was included for the analysis. Banks also reported their earnings, interest, and profit from each of these sectors.

Figure 6 Participating banks (a-left) outstanding by sector (MNT trillion) (b-right) Earnings, interest and fees (billion MNT) last 2023



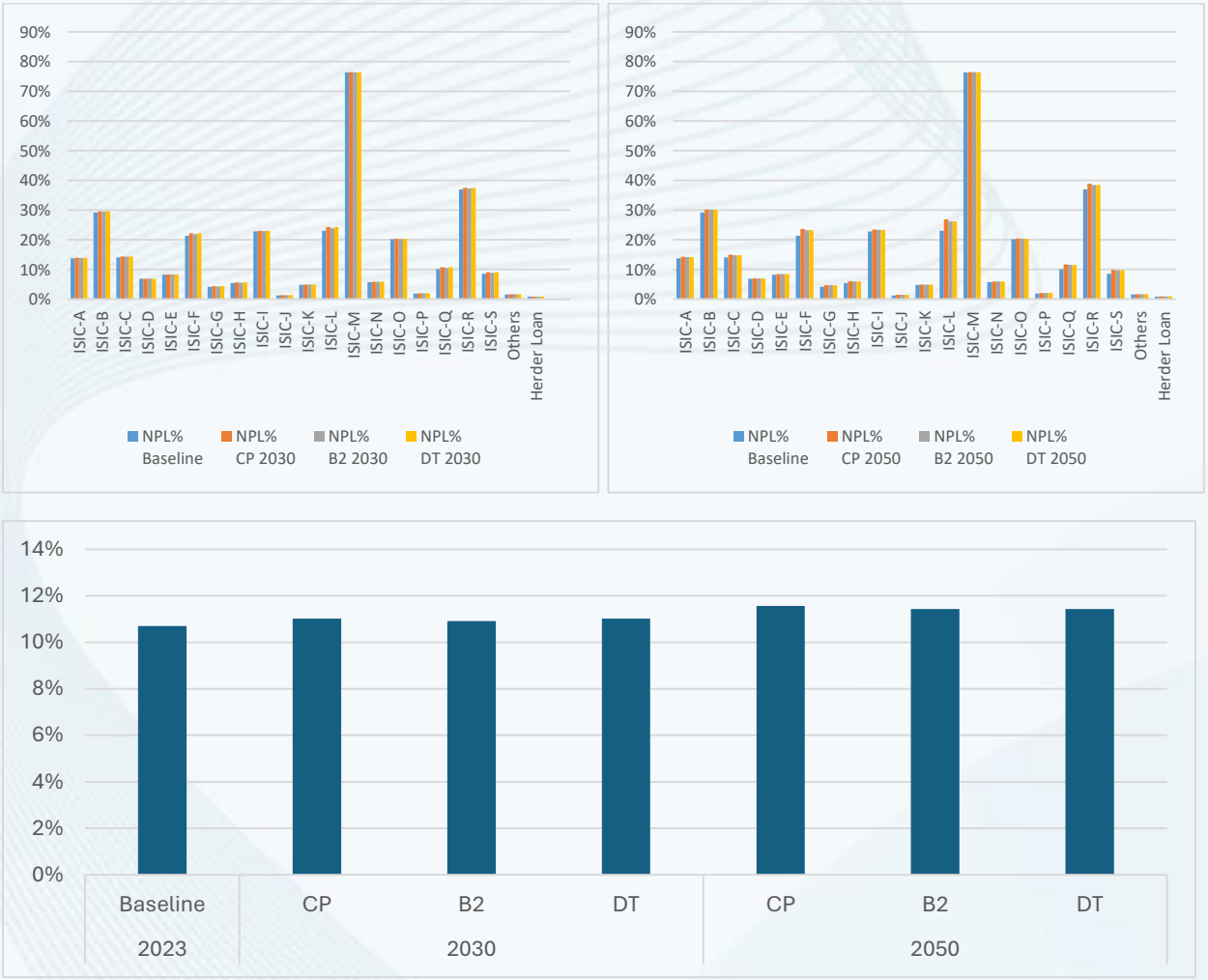
Source: Bank of Mongolia.

The sectoral analysis of exposures of participating banks reveals critical concentrations in a few sectors. ISIC G (Wholesale and Retail Trade) stands out as the most significant exposure, with both the highest outstanding loans and earnings. ISIC B (Mining and Quarrying) and ISIC F (Construction) also show substantial exposure and income generation, though with considerable inter-bank variance, suggesting concentrated risk in specific institutions. In contrast, ISIC C (Manufacturing) presents a concerning profile, with high outstanding loans but relatively low and uniform earnings, implying inefficient capital allocation or heightened

credit risk. Herder Loans show moderate exposure with volatile and generally low returns, reflecting a potential trade-off between policy objectives and financial sustainability. Meanwhile, sectors such as ISIC L through ISIC R, and Others (ISIC T, U), exhibit low exposure and earnings with narrow distribution ranges.

Banks then estimated credit risks on their portfolios under the three transition scenarios keeping a static balance sheet for each ISIC sector and herder loans category. The portfolio as of end of December 2023 was used for analysis. Using the portfolio values of December 2023, banks reported baseline credit risk parameters, including the percentage of loan amounts classified as performing, special mention, and non-performing, along with the probability of default. Using these baseline values and based on input data provided for three future scenarios, banks subsequently recalculated these indicators to assess the evolution of credit risk under each scenario for the years 2030 and 2050.

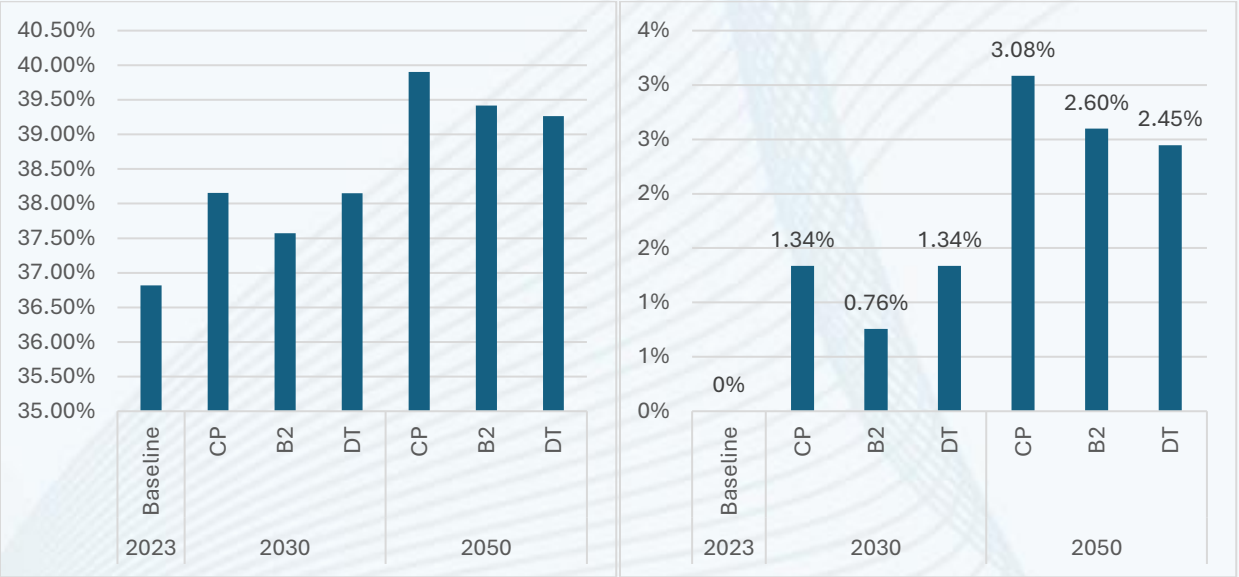
Figure 7 Aggregate NPL calculations



Source: Bank of Mongolia.

Majority of the banks did not incorporate the scenario parameters into NPL estimations which largely remain unchanged from baseline across scenarios in 2030 and 2050. For the banks that have used scenario variables to estimate future NPL percentages minor changes appear only in 2050 but remain limited to a few sectors.

Figure 8 Aggregate LGD estimations, absolute and per cent point change from baseline



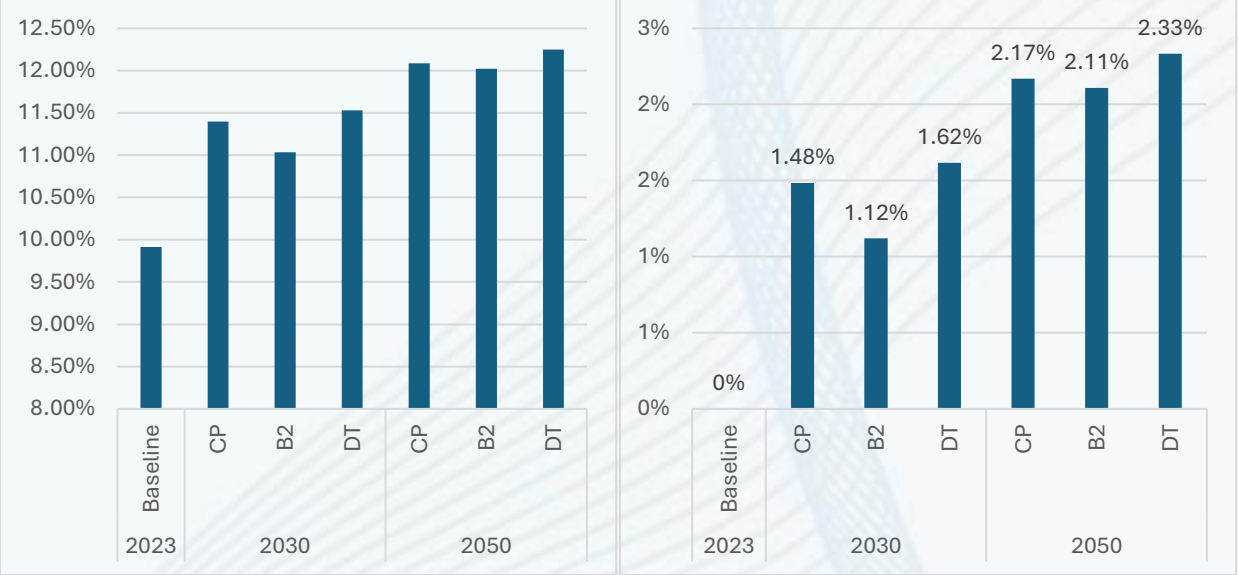
Source: Bank of Mongolia.

The loss given default (LGD) cumulatively increases by 0.7 to 1.3 percentage points in 2030. This is also due to the fact that the scenario description for Current Policies (CP) and Delayed Transition (DT) is the same until 2030, changes under the Delayed Transition scenario begin after 2030.

The LGD increases (almost doubles) in 2050 for all scenarios and ranges from 2.5 to 3 percentage points. Current Policies scenario has the highest LGD in 2050 reinforcing the fact that no action would have the highest cost on the financial sector.

However, for LGD it must be noted that the approach used by different banks varies between the participants. While some banks have used sector specific coefficients to incorporate changes in LGD for all sectors and for all scenarios, there are also banks that have applied constant coefficients across sectors due to lack of sector specific modeling capacities and scarcity of historical data on LGD. At the same time there are also a few banks that have worked with constant LGD for scenarios.

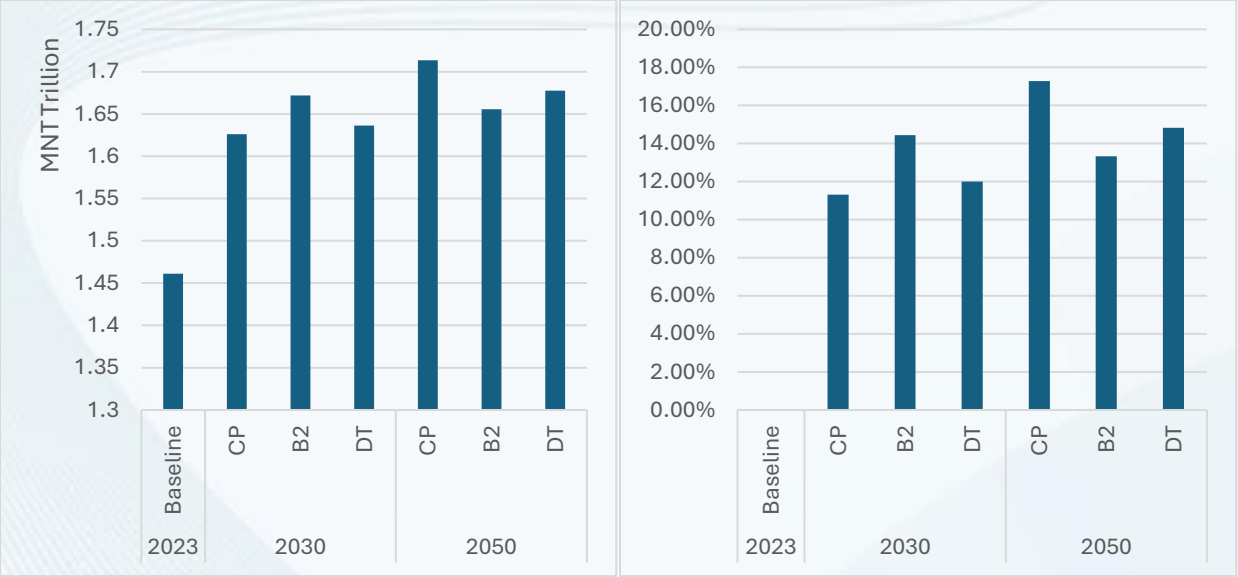
Figure 9 Aggregate PD estimations, absolute (left) and per cent point change from baseline (right)



Source: Bank of Mongolia.

The probability of default (PD) increases least under the Below 2^{0}C (B2) scenario in 2030 and 2050. In both cases, the PD is highest under the Delayed Transition, which could be intuitively understood as adverse effects of a disorderly transition that happens after 2030. The highest increases in PD are seen in the agriculture, mining, and construction sectors.

Figure 10 Aggregate ECL estimations, absolute (left) and per cent point change from baseline (right)



Source: Bank of Mongolia.

The expected credit loss (ECL) estimations show a significant credit risk increase across all banks. In 2030, ECL increased highest under Below 2^{0}C scenario. This is reasonable as the

scenario entails immediate and significant changes in policy, which lead to higher macroeconomic volatility in the short run. ECL increases by 14.45 per cent as compared to baseline under this scenario, with an additional 211 billion MNT expected losses. The Delayed Transition and Current Policies scenarios have similar losses in 2030. ECL increases by 12 and 11 per cent respectively in 2030 with additional losses equaling 175 and 165 billion MNT.

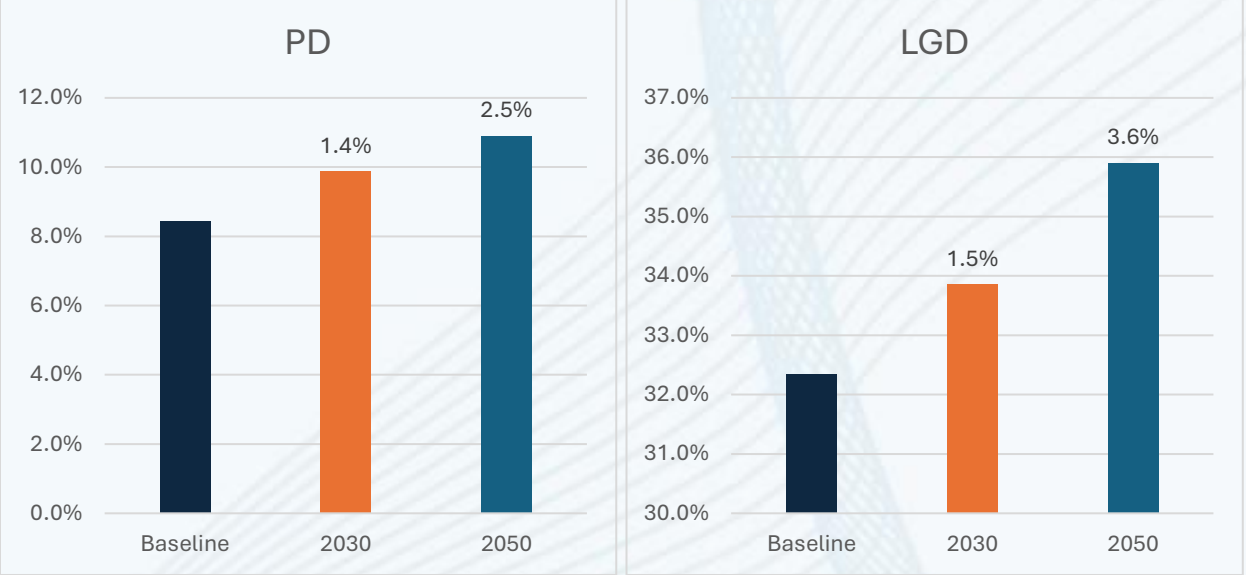
In 2050, the highest losses are seen under the Current Policies scenario. ECL increased by 17.3 per cent as compared to baseline with additional expected losses of 253 billion MNT. This demonstrates that the losses will be the most severe under a no additional action pathway. In contrast, under the Below 2^0C scenario (immediate action pathway) in the long run i.e. 2050 the economy reaches a more stable state, and the expected losses are the lowest. ECL increases by 13.3 per cent with additional losses estimated to be 195 billion MNT compared to the baseline. The Delayed Transition scenario lies between the other two scenarios with ECL increase of 14.8 per cent relative to the baseline, corresponding to 168 billion MNT in additional expected credit losses. The estimations reinforce the need for immediate action to minimize the adverse effect of climate change to the financial system in Mongolia. Even under the optimistic immediate action pathway of the Below 2^0C scenario, the financial system would need to prepare for short term effects (2030) while in the long term (2050) even though the losses are lower than the other two scenarios they still represent an increase in credit risk from the baseline.

Credit risk under drought and dzud scenario

Physical risk from slow-onset disasters like droughts and dzuds can have a much more pronounced impact in Mongolia. This is further compounded when dzuds and droughts occur in the same year. The agriculture sector is directly impacted by such events, with massive losses of livestock impacting herders' income and production in associated sectors. Other sectors also face second-order impacts. Under the scenario, it was assumed that a severe combination of drought and dzud would occur in 2030 and 2050, and the losses and macroeconomic conditions would worsen with increasing severity in the respective years.

Banks used a static balance sheet to estimate credit risk parameters (PD, LGD, and ECL) for each sector (ISIC sectors and Herder Loans) for the years 2030 and 2050. Compared to the 7 banks under transition risk scenarios, only 6 banks provided the data for the drought and dzud scenarios.

Figure 11 Aggregate PD and LGD estimations under dzud and drought scenario

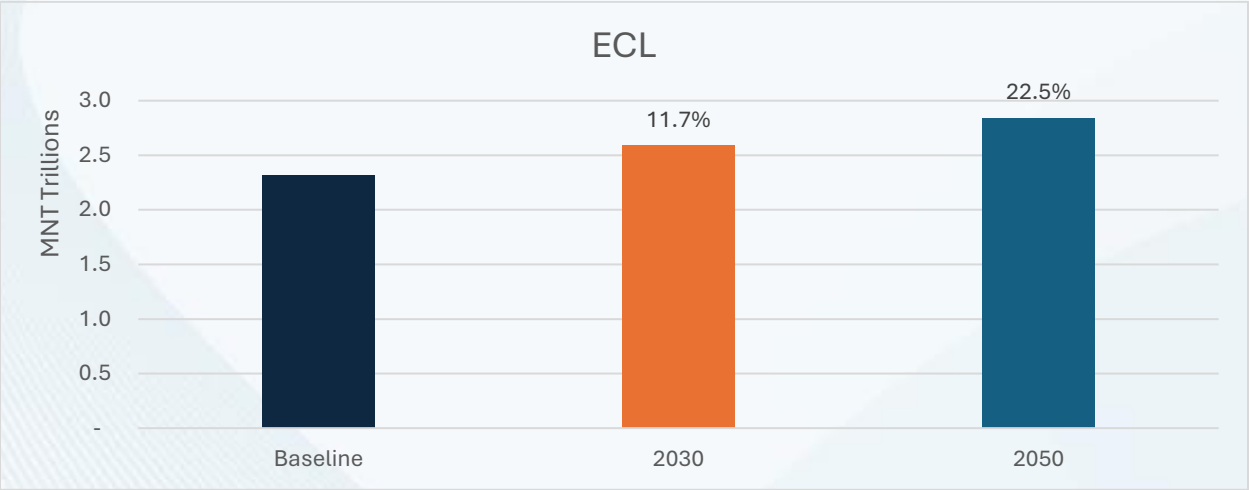


Note: Y-axis represents absolute value in per cent, data labels represent per cent point change from baseline.

Source: Bank of Mongolia.

The probability of default (PD) and the loss given default (LGD) increase by around 1.5 per cent in 2030. The increase is more significant for banks that have a higher share of loans to herders and the agriculture sector. In 2050 the PD and LGD increase significantly, 2.5 per cent and 3.6 per cent higher than the baseline respectively. Both LGD and PD are higher for agriculture sector corporate and business loans in comparison to herder loans, signaling higher resilience of individual borrowers to these events than businesses.

Figure 12 Aggregate ECL estimations under dzud and drought scenario



Note: Y-axis represents absolute value in MNT trillions, data labels represent per cent change from baseline.

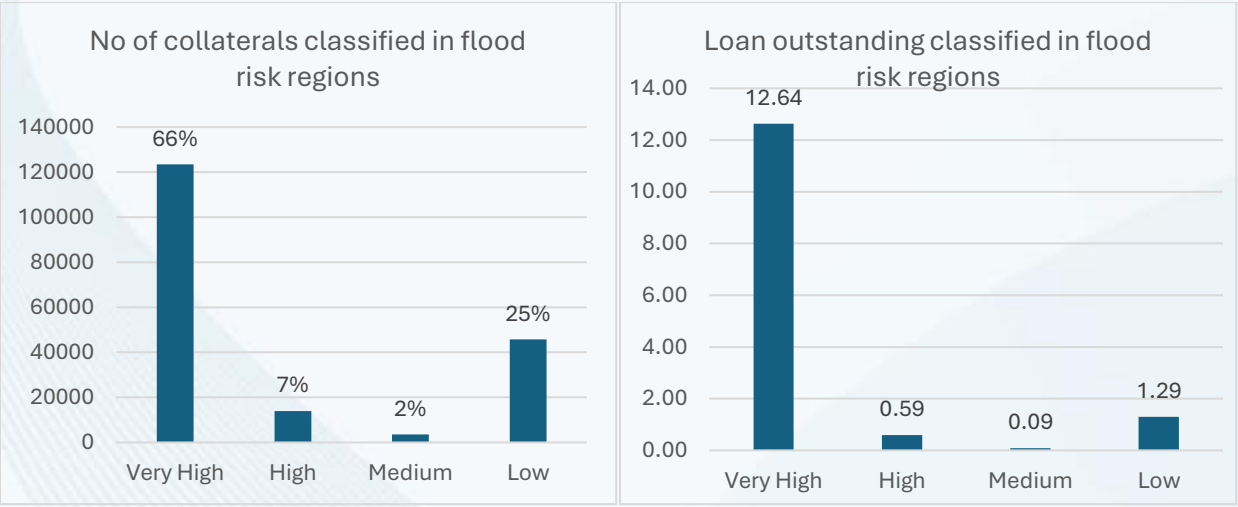
Source: Bank of Mongolia.

Due to the impact of the drought and dzud, expected credit losses (ECL) increases by 11.7 per cent, equivalent to an additional 273 billion MNT, in 2030 compared with the baseline. As the severity of these events increases in 2050, the additional expected losses almost double, reaching 522 billion MNT and marking a 22.7 per cent increase over the baseline. It is also interesting to note that the estimated expected credit losses from such severe physical risk events are significantly higher than those coming from transition risks alone in the pessimistic scenarios. This demonstrates that the physical risk effects are more significant in Mongolia. At the same time, it must be noted that transition risks and physical risks do not operate in isolation; a compound effect of economic transition with increased severity of disasters could potentially have very severe impacts on the financial system. Thus, while preparing for an orderly and timely transition is important to minimize transition risks, equal emphasis must be given to adaptation and resilience building to safeguard against the physical risks.

Credit risks from floods

To estimate credit risks from floods, a compound flood risk map at soum (district) level was created (Figure 5) and banks were instructed to classify all mortgage loans as well as loans collateralized by real estate according to the geographical risk zone of the asset. Each risk level was assigned a price shock to residential and commercial real estate. Banks then applied this price shock to the loans to estimate the credit risk parameters like LGD, loan provision and ECL. Since it is assumed that a flood occurs and a price shock is applied to estimate losses, PD was set at 100 per cent. All 7 participating banks provided data for flood risk estimations.

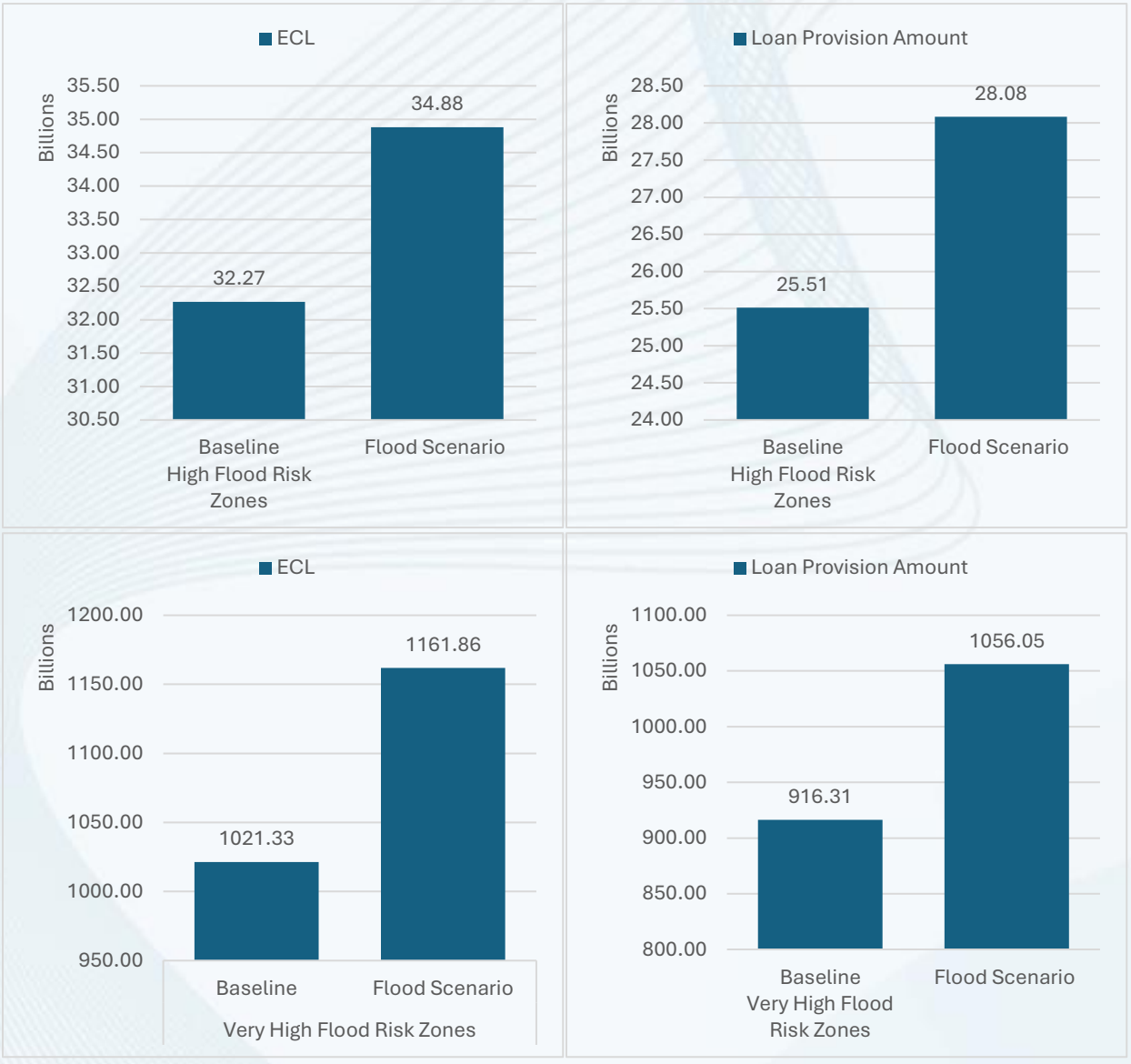
Figure 13 Aggregate number of collaterals classified as per flood risk regions (left) and aggregate loan outstanding per flood risk region (right)



Source: Bank of Mongolia.

Most of the collateralized loans and mortgages (66 per cent) across banks are concentrated in very high flood-risk areas. Ulaanbaatar has the biggest concentration of economic activity and population in the country and is at a very high risk of flooding. Other big cities by population, like Erdenet and Darkhan, located in the northern part of the country, also fall under very high flood-risk zones. The very high-risk zones represent outstanding loan volume exposure worth 12.64 MNT trillion.

Figure 14 ECL estimations (left) and loan provision amount estimations (right) under flood scenario for high and very high flood risk zones



Source: Bank of Mongolia.

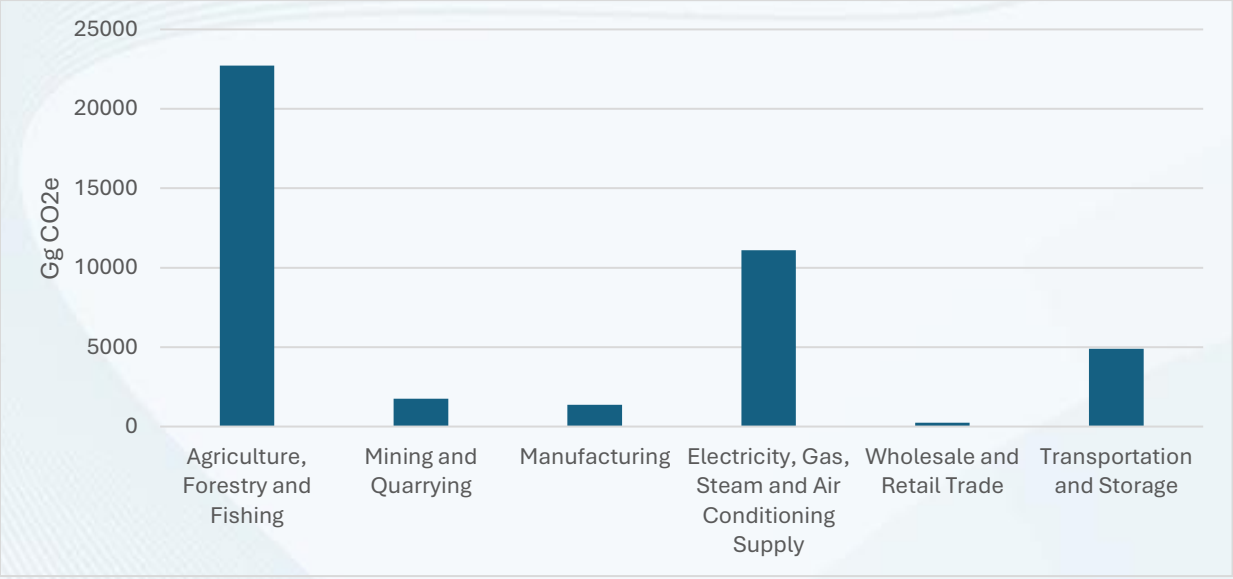
The estimated impacts of flood scenarios on Expected Credit Loss (ECL) and Loan Provision Amounts across High Flood Risk Zones and Very High Flood Risk Zones are significant. In

High Flood Risk Zones, despite lower exposure, the ECLs increase from 32.27 billion MNT under the baseline to 34.88 billion MNT under the flood scenario, an 8.1 per cent rise. Correspondingly, the Loan Provision Amount increases from 25.51 billion MNT to 28.08 billion MNT, a 10.1 percent increase, indicating that banks anticipate elevated credit risk and potential defaults due to flooding. In Very High Flood Risk Zones, the effect is even more pronounced. ECL rises from 1021.33 billion MNT to 1161.86 billion MNT, marking a 13.8 percent increase, while Loan Provision Amounts grow from 916.31 billion MNT to 1055.05 billion MNT, a 15.1 per cent rise.

Transition risks as financed emissions

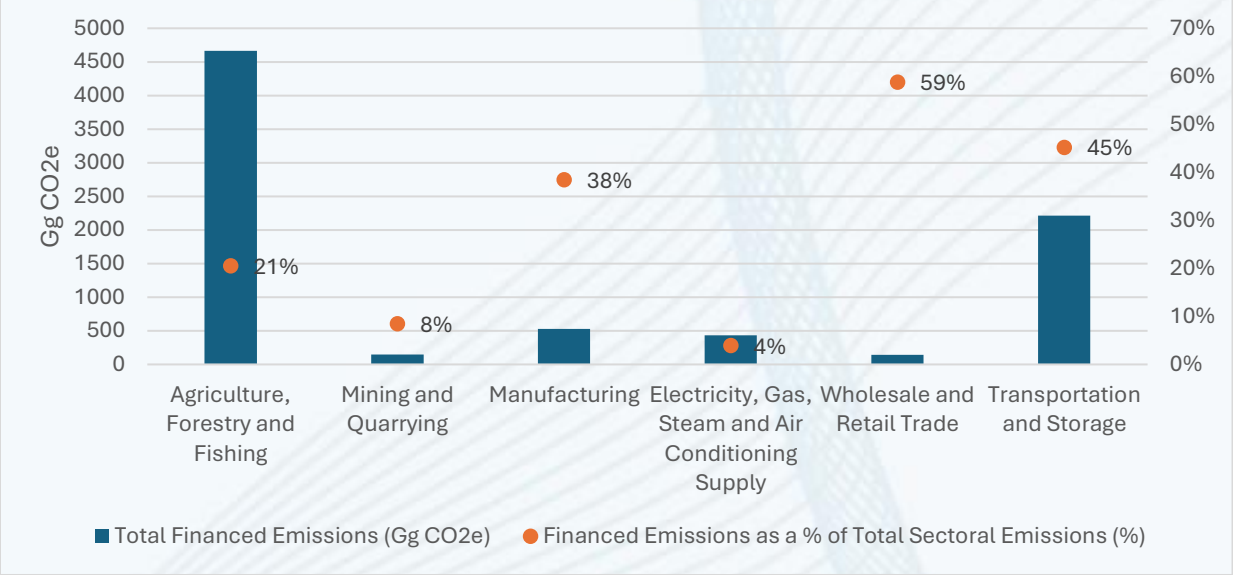
Banks estimate financed emissions from their corporate loan portfolios. A key challenge in estimating finance emissions was the lack of data from the counterparties, which limited the banks' ability to produce estimates with high confidence. While a few banks had access to methodologies for estimations, the majority of the participating banks lacked sufficient capacity and data. To address this gap Bank of Mongolia advised the banks to use proxies and use the financed emissions estimation tool developed by Mongolian Sustainable Finance Association and Sparkassenstiftung for Mongolian financial institutions. For the banks that used their own methodologies, estimations were recalculated using the estimation tool to ensure consistency, aggregation and comparability. The emissions inventory from Ministry of Environment and Climate change was used.

Figure 15 Country wide emissions by sector



Source: Mongolia's National Inventory Report-2023 Annex to Second Biennial Update Report To UNFCCC.

Figure 16 Aggregate finance emissions estimations for selected sectors



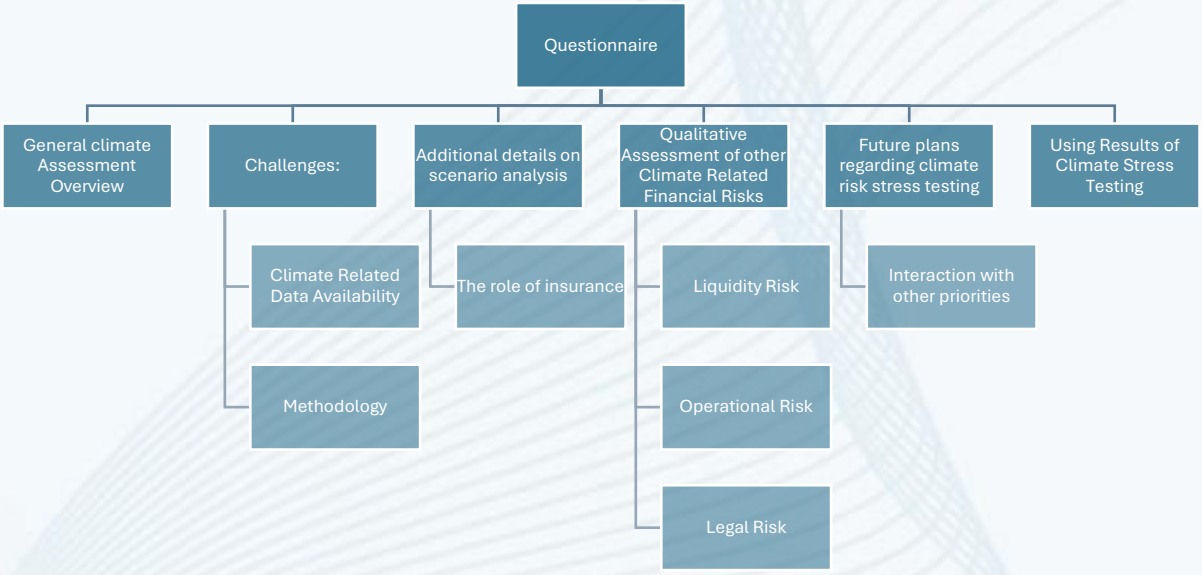
Source: Bank of Mongolia.

Financed emissions from banking sector lending in the country account for 23 percent of total national emissions. This indicates that a substantial share of emissions is supported by non-banking financial sources, particularly in key emitting sectors. Among participating banks, the agriculture sector records the highest share of financed emissions, which aligns with its dominant contribution to national emissions. Conversely, financed emissions in the mining and electricity sectors are comparatively low, likely due to these sectors being primarily state-funded or reliant on foreign direct investment. While this limits direct banking exposure, it raises transition risks for governments and international investors if these sectors face decarbonization pressures. Notably, approximately 50 percent of transportation sector emissions and about 40 percent of manufacturing sector emissions are financed by banks. This exposure suggests that these two sectors may present strategic opportunities for banks to focus their decarbonization efforts and align lending portfolios with climate targets.

Qualitative findings

The qualitative assessment was designed to understand the current climate risk management practices in the banking sector and qualitatively assess some aspects of other risk types, such as Liquidity, Operational and Legal risks. The banks responded to the qualitative questionnaire in adequate detail, providing necessary explanatory notes where requested. Relevant personnel from relevant departments filled out the respective sections of the questionnaire. Figure X shows the structure of the questionnaire.

Figure 17 Overview of the qualitative questionnaire



Source: Bank of Mongolia.

General climate risk assessment at the banks: A Limited number of banks have started to properly assess climate change-related risks. However, the assessments remain qualitative and have varying materiality and degrees of interpretation. Banks continue to focus on short-to-medium term horizons when it comes to the assessment of climate risks. Most banks have some sort of climate mitigation or management plans in place, but the level and focus vary significantly across banks. All banks have at least one kind of climate-related financial risk material for their organization. While market risks are material to banks, they are not being measured. Risk perception at the portfolio level depends on the composition of the portfolio of the banks. Climate Stress testing seems like the natural next step for most banks in their climate risk assessment and management practices and plan to take action to integrate stress testing.

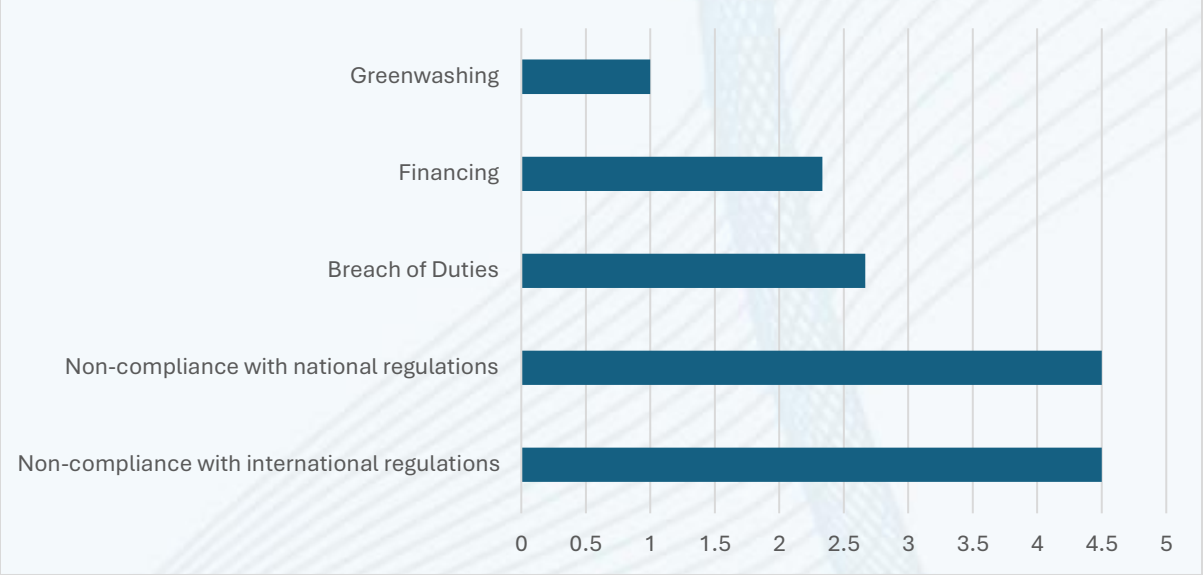
Data and methodology related challenges faced during the pilot CSA: Banks need to continuously improve classification at the loan level (sector, purpose, collateral, loan type) to have necessary categories to estimate risks from different drivers. Modelling credit risks with the incorporation of climate and climate-impacted macroeconomic variables is a

challenge for all banks. Additional capacity building for risk modeling at the portfolio level is needed. Almost all banks expressed the ability of the internal stress test model to produce credit risk parameters at the required granularity (i.e. disaggregated by industrial sector/energy efficiency rating) or connecting scenario assumptions to credit risk parameters (e.g. PD, LGD) as a common challenge. Lack of sector-specific risk models and materiality of different sectors in different portfolios. Classification of small business loans as consumer loans. Frequency mismatch between bank models and climate data. Lack of historic trends for macro-financial variables like electricity price, carbon price, emissions and consequent weak correlations.

Role of insurance: Insurance penetration in the banking sector is higher than the national average (6 per cent). Banks remain heterogeneous in the usage of insurance based on the differences of the composition of their respective loan portfolios. Some banks are at higher risk due to a lack of insurance protection. Banks are heterogenous in their coverage of insurance for corporate loans (from more than 75 per cent to just 0-15 per cent). The majority of the banks have their collateralized loans and mortgages covered by insurance. Tailored insurance products can help reduce risks and expected losses.

Legal risks: Climate change-related legal risks have low materiality for banks at this stage, despite a sound conceptual understanding. Most banks consider non-compliance with national or international regulations as the primary potential source of legal risks, while greenwashing is the least likely source. None of the banks in the exercise have evaluated potential legal risks from their operations at this stage and hence do not have any legal risk mitigation plans to hedge against them. Banks also differ in their assessment of sources with the highest potential of legal risks. Almost all banks consider non-compliance with either international or national regulations as the most probable source of legal risks. For all banks, “Greenwashing” has the least potential as a source of legal risks. All banks, however, demonstrate a sound understanding of the concept of climate-related legal risks.

Figure 18 Average score of potential legal risk sources (5 highest)



Source: Bank of Mongolia.

Operational risks: All banks have some form of business continuity plan/policy (Disaster recovery plan, emergency plan) in place to assess and manage climate change related operational risks particularly those driven by physical risk drivers. However, some banks are not clear on how climate related operational risks are similar to natural disaster related risks which highlights the need for additional awareness creation and capacity building on the topic. Measures in place include:

- Internal business continuity plans
- Business impact analysis
- RCSA methodology
- Assessment of natural disaster impacts on operations.

Liquidity risks: Banks understand liquidity risks from climate change, however, their impacts based on their potential drivers are currently seen as indirect and, in some cases, unlikely. Banks have traditional liquidity risk management measures in place, especially adhering to regulatory requirements but the integration of climate risk components is limited to a few institutions. Several banks believe that physical risk shocks can lead to liquidity risks for their organization through the credit risk channel, market risk (asset devaluation) channel, insurance channel, and client need for liquidity channel. Measures include:

- Maintaining higher than internal limit liquidity ratios, diversification of funding sources, regular stress testing, funding reserve plans

- Liquidity crisis management plans and Internal Capital Adequacy Assessment Process (ICAAP) & Internal Liquidity Adequacy Assessment Process (ILAAP).
- Compliance with regulatory requirements
- Regular monitoring of potential liquidity risks
- Contingency Plan for Actions to Be Taken in Exceptional Circumstances
- Usage of central bank securities and trading & investment securities as well as withdrawal of funds placed in domestic and foreign banks.

Market risks: Banks have limited exposure to high transition risk sectors (0-20 per cent), partly due to regulations that limit lending to mining and the state-owned nature of the energy industry. Consequently, market risks from climate change are not evaluated by banks. However, a few banks report plans to assess these risks in the near future. Given the limited bottom-up analysis of market risks, a top-down assessment to estimate potential losses would be useful. Only one bank reported evaluating possible asset revaluation due to climate change related risks through models. However, the details are limited to revaluation of private houses located in areas prone to physical risks of climate change.

Future steps on integration of climate risk assessments: Most banks plan on strengthening their climate risk assessment frameworks by improving data collection, aligning with international regulatory developments, and enhancing transparency through disclosures—though approaches and motivations vary, with some banks taking additional steps like external consultancy, standardized databases, or integrating climate risks into risk limits and insurance coverage. Top priority areas of work include:

- Improving data collection efforts from their counterparties as well as engaging with data providers.
- Engaging external consultants to improve the management of climate risks.
- Improving and maintaining data and information records, while establishing a standardized database with unified criteria.

Usage of CSA results: Almost all banks affirmed that climate-related regulatory developments outside Mongolia promoted or influenced the development of a climate risk assessment framework in their institutions. (Paris Agreement, International Financial Reporting Standards (IFRS), investor requirements). Several banks plan to disclose the results of the climate risk stress test under Basel Pillar-III reporting. Almost all banks intend to share the results of the climate scenario analysis as part of their public reports or in other cases to rating agencies and to credit investors. Few banks intend to use these results to inform them of their risk limits or metrics (Value at risk , Exposure at default, Expected loss) and their application for lending in certain sectors and for certain clients. Based on the

findings of the exercise almost all banks leaned towards the inclusion of insurance policies for physical risk related losses and insurance covering immovable properties.

In conclusion, the qualitative climate risk assessment exercise revealed that while Mongolian banks have made initial strides in integrating climate-related risks into their broader risk management frameworks, the efforts remain fragmented, largely qualitative, and uneven across institutions. There is a general recognition of the relevance of climate risks particularly credit and operational risks yet significant gaps remain in the measurement, modeling, and integration of these risks into core financial and risk management processes. Challenges related to data granularity, methodological alignment, and internal capacity persist across banks, particularly in areas such as climate scenario modeling, portfolio-level analysis, and translating qualitative insights into actionable parameters. The exercise also highlighted varying levels of maturity in the treatment of insurance and legal risks, as well as the underdeveloped assessment of market and liquidity risks. Despite these challenges, banks demonstrated a clear willingness to strengthen their practices through improved data systems, capacity building, external support, and regulatory alignment. The assessment serves as a foundational step toward building a more comprehensive and forward-looking climate risk management ecosystem in Mongolia's banking sector.

Key insights and lessons learned

Consistent with the defined objectives, the climate risk assessment exercise revealed a range of methodological approaches and highlighted important lessons for future improvements. While adhering to IFRS 9 principles, participating banks employed diverse modeling techniques, with varying approaches to incorporate macroeconomic scenario variables for calculating Probability of Default (PD), Loss Given Default (LGD), and Expected Credit Loss (ECL). These differences reflect the heterogeneity in banks' climate risk management capacities and the distinct sectoral focus of their lending portfolios. Consequently, it highlighted a need for a tailored approach to climate risk analysis that aligns with each bank's specific exposure profile and material risk drivers.

Additionally, banks incorporated micro-level financial variables to differing extents, pointing to varying levels of integration of climate considerations into existing credit risk models. A key challenge banks echoed by all banks was the lack of sector specific models and historical data, as current models use segment wise (business, SME, retail, mortgage) classification for credit risk estimations. This provides key insights into future capacity building initiatives that need to support the development of sector specific estimation methodologies.

After the analysis of the first round of submissions by banks, the Bank of Mongolia (BoM) scheduled individual sessions with each participating bank to discuss their specific results, identify methodological gaps, and agree on next steps for refinement. Several banks were asked to re-estimate certain results based on discussions and clarifications. The integration of forward-looking variables into credit risk models, especially those for which historical data is limited or unavailable, remains a key challenge. This underscores the need for banks to further adapt and evolve their internal risk modeling frameworks.

Another major challenge identified is the quality and availability of data. Banks are expected to continue engaging with their counterparties to strengthen data collection systems and improve the reliability of input data. This will be critical to enhancing the robustness and comparability of future climate risk assessments. Overall, the exercise has laid a strong foundation for iterative learning and capacity building, with BoM committed to supporting banks through technical assistance and collaborative dialogue.

Conclusion and next steps

The climate scenario analysis successfully achieved its core objectives, marking a significant milestone in advancing climate risk understanding and practices within the Mongolian financial sector. The exercise helped build foundational capacities across participating institutions to assess and interpret climate-related risks, particularly those stemming from physical vulnerabilities specific to the region and transition risks arising from policy shifts toward a low-carbon economy. It also enabled banks and the Bank of Mongolia to identify key data and methodological gaps, including in the estimation of GHG emissions, credit losses, and counterparty exposures, which are critical for improving future risk assessments.

As the first initiative of its kind in the country, the exercise provided valuable first estimates and offered practical insights into climate risk modeling across a range of banking portfolios. Importantly, the voluntary participation of two additional banks beyond the five systemically important institutions highlights growing recognition of the materiality of climate-related financial risks and a sector-wide willingness to integrate climate considerations into internal processes and regulatory frameworks.

Looking ahead, BoM will continue to support the evolution of methodologies in line with emerging science and international best practices while working to strengthen internal supervisory capacity. BoM also encouraged banks to further develop their own internal modeling approaches, build technical capacity within credit risk teams, and regularly test their portfolios for climate risks. These efforts should be embedded in voluntary disclosures

and ESG reporting frameworks, which will be monitored and supported by BoM. Several participating banks have already expressed intent to apply the results of this exercise to improve their risk management systems and fulfill climate-related reporting obligations.

Building on these foundations, the Bank of Mongolia's Green Vision provides a strategic framework for integrating the findings of this scenario analysis into its broader greening agenda. The Green Vision outlines concrete short to medium term actions, including formalizing climate scenario analysis as part of macro-prudential surveillance, enhancing disclosure requirements, and developing regulatory incentives. These priorities will guide the BoM's continued efforts to strengthen supervisory capacity, improve climate-related data collection, and align monetary and financial stability objectives with Mongolia's sustainable development commitments.

As the banking sector moves from awareness to action, continued collaboration, peer learning, and iterative methodological improvements will be essential. The momentum generated through this exercise establishes a platform for the BoM and the financial community to jointly operationalize climate risk management, translating insights from the climate scenario analysis into concrete steps toward a more sustainable and climate-resilient financial system.